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FIRST COMMITTEE

Note by the Chairman

In order to assist the Committee in the consideration of the questions relating to economic implications of sea-bed mining, the Chairman of the First Committee has prepared the following note containing the major summaries and conclusions of the pertinent documents presented to the Conference.

1. Basic documents

- Economic Implications of Sea-Bed Mineral Development in the International Area: Report of the Secretary-General (A/CONF.62/25)
- Statement made by G. D. Arsenis on behalf of the Secretary-General of UNCTAD (A/CONF.62/32)
- The effects of possible exploitation of the sea-bed on the earnings of developing countries from copper exports: Report of the UNCTAD secretariat (TD/B/484)
- The effects of production of manganese from the sea-bed, with particular reference to effects on developing countries producers of manganese ore (TD/B/483)
- Exploitation of the mineral resources of the sea-bed beyond national jurisdiction: case study of cobalt (TD/B/449/Add.1)
- Exploitation of the mineral resources of the sea-bed beyond national jurisdiction: issues of international commodity policy. Note by the UNCTAD secretariat (TD/B/449)
- Mineral production from the area of the sea-bed beyond national jurisdiction: issues of international commodity policy (TD/113/Supp.4).

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II. Summary and conclusions of the Report of the Secretary-General (A/CONF.62/25)

1. This summary provides a brief review of the contents of the report. In view of the complexity of the subject, however, it necessarily omits much of the analyses and accordingly should not in any sense be taken as a substitute for the text of the report itself.
2. Manganese nodules are the most likely deep-sea minerals to be exploited in the foreseeable future. Nodules are composed of fine-grained oxide material and are distributed widely over the floor of the world ocean. They vary widely in their composition, as well as in their physical and chemical properties. There is now considerable commercial interest in exploiting them for their component metals, chiefly nickel, copper, cobalt and manganese.
3. Only about 3 per cent of the sea floor has been extensively surveyed. However, intensive exploration in recent years has revealed enough about the extent and location of deposits to permit commercial exploitation of nodules. Potential commercial deposits exist in the Pacific and Indian Oceans, while none have yet been located in the Atlantic Ocean.
4. Various commercial groups have completed the exploration or prospecting phase and are now evaluating potential mine sites. Site evaluation focuses on estimating the average concentrations of the constituent metals in nodules and on the nodule density per unit area of the mine site. These are the key parameters which, with bottom topography, affect the potential profitability of a mine site. There is great interest in the central Pacific region, which contains extensive concentrations of higher value nodules. Within this region, some evidence suggests that nodules with the highest potential value are concentrated in an east-west belt between 6° N and 20° N latitude and extending between 110° W and 180° W longitude.
5. The physical problem of recovering the nodules from the sea floor is proving to be a difficult one. As surficial deposits, nodules will be dredged and either pumped or hoisted from the sea floor. At the surface facility the nodules will then be loaded into barges or ore carriers for transportation to a processing plant. Under hydraulic lifting systems the nodules must be concentrated within a relatively small area so that the suction system can operate efficiently; this gathering process seems to be one of the most serious stumbling blocks in test operations.
6. Several national Governments have been and are involved in nodule mining through various forms of direct and indirect subsidization of mining activities. They have funded research on exploration, offered tax relief and the use of government facilities for research on processing, and in some cases Governments are contemplating direct participation in mining ventures.
7. By most estimates, it appears that nodule mining will prove to be a commercially profitable operation. Although the physical, technical and logistic problems are formidable, the existing technological capability can allow the industry to work. The question of the probable impact of sea-bed mining on world markets centres on the degree of competitiveness between marine and land-based sources of metal supply. To be

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rigorous, a study of this question would require a comparison of the relative supply costs of these two sources. This is not practicable for the following reasons: (a) most information on estimated costs of individual firms or consortia is still proprietary and closely guarded; (b) as the industry matures costs will drop from initial levels due to a "learning-by-doing" effect. Also, technical progress in engineering, materials, and design will serve to further reduce costs over time; (c) the range of costs among land-based producers is extremely wide, making it difficult to find a uniform supply price for land-based producers as a whole; (d) the profitability of nodule mining, the volume of production, and the impact on prices will be affected by the nature and extent of any regulation of the industry by the Sea-Bed Authority.

8. Therefore, in order to approximate the likely impact of nodule mining, certain assumptions must be made to facilitate the analysis. In this report, the assumptions made are based on the latest information available, on the discernible trends, and on the known plans of sea-bed miners.

9. Given the state of preparedness of the industry, commercial metal production from nodules could commence toward the end of the decade, though nodule mining might start as early as 1976. The decision to go ahead and begin production will depend on whether: (a) the firms feel that their mining and metallurgical processing technology is economically viable; (b) that they are on safe legal grounds with security of investment and assurance of exclusive access to their chosen mine sites; and (c) that they have adequate financing for their ventures. Once the go-ahead decision is made, it is assumed that commercial operations can commence within three to five years.

10. Perhaps the most critical assumptions deal with the expected rate of development of the nodule industry, the average grade of nodules processed, the constituent metals to be recovered and the metallurgical yields. Metal production from nodules will be affected by the pattern in which new operations enter the field each year and by increases in capacity of existing operations. Economies of scale will dictate the size of individual operations; the likely sizes being of 1 and 3 million ton capacities. Six groups are expected to be in operation by 1985, the total volume of dry nodules being processed in that year amounting to 15 million tons.

11. According to most experts, nickel will be the mainstay of the nodule industry. Copper, cobalt and nickel will be produced jointly, with manganese and several trade metals probably being produced as by-products from the tailings. As a guideline for their own planning, nodule miners look for a combined nickel and copper content equal to 3 per cent of the dry weight of nodules. Other metals will be recovered if the additional costs of processing are covered by the additional revenues from these metals, which in turn depends on their prices. Thus, there can be no uniform, industry-wide assumptions about production of other metals. For example, industry plans vary widely with respect to manganese production, not only regarding its volume but also its form, i.e. ore, ferromanganese or manganese metal.

12. For nickel, a minimum 6 per cent per annum long-term growth rate is assumed. In 1972, the share of developing countries in world production of nickel was only 13 per cent, although this share is expanding rapidly. Production from nodules might amount to 18 per cent of the total world demand in 1985. This volume of production would depress prices somewhat, but the impact would be lessened by the good growth prospects for

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nickel, and by the fact that developing producers account for a small share of the total market. Nickel production from nodules might cause some high cost laterite projects under consideration to be abandoned, but it should not have a serious effect on land-based production as a whole.

13. The world market for copper is huge compared to that for nickel, being about 14 times the size of the nickel market in 1972. Copper prices rose dramatically from 1970-1974, reaching a record level of \$US 1.10/lb. in early 1974. Of the metals contained in nodules, copper production is the least concentrated among producers. It is expected that the demand for copper will show an annual percentage growth rate of 4-5 per cent to the end of the century. Production from nodules might supply about 1.3 per cent of world consumption in 1985 and would displace only 5.5 per cent of the net import requirements of developed countries by that time. Copper production from nodules is expected to have a minimum impact on a relatively large, growing and somewhat diffuse market.

14. Manganese might be recovered from nodules in two forms, either as pure metal or as ore-equivalent. More than 90 per cent of the manganese produced is used in the form of ferromanganese in the manufacture of steel; thus the rate of growth in its consumption will tend to parallel that of steel production. On the other hand, the market for manganese metal is relatively small. Metal production from one operation of 1 million tons/year in 1985 might amount to twice the volume of projected demand. Therefore, manganese metal supply from nodules would depress prices. Depending on the form and volume of manganese recovery from nodules, the export earnings of developing country producers might drop significantly. However, with just one exception, developing countries are not dependent upon manganese exports to a great degree.

15. Cobalt is a relatively expensive metal with a small market, and its value in world commodity trade is rather small. By 1985, production from nodules could account for about half the volume of world output while effecting a drop in price to about two thirds of current levels.

16. The long-term prospects of the nodule industry are tied closely to nickel and copper. In the long-term, if capacity expansion in sea-bed mining was sufficiently large to depress the price of nickel to approximately the price of copper, this would open up some important substitution possibilities of nickel for copper. In this case, the prospects for the industry might warrant a large second-round expansion. This scenario is somewhat speculative, and possible only in the absence of any form of regulation.

17. Although everyone agrees that nodule resources should be developed in a rational manner, opinions differ on what specific objectives come under this very general goal. In the Sea-Bed Committee, several policy objectives were proposed and discussed, in particular: to encourage nodule development so as to enlarge the world resource base, to minimize the impact of nodule exploitation on developing countries exporters of minerals, to ensure the participation of developing countries in sea-bed mining activities, to promote the conservation of nodule resources and to preserve the marine environment.

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18. Some of these objectives and the conflicts between them indicate the need for a trade-off between efficiency and equity, which is one of the fundamental issues under any form of economic organization. Some would argue that the nodule industry should be free to operate without restraint, since under conditions of competition and free entry, the nodule resources would then be developed at minimum cost. Others contend that unrestricted nodule exploitation would benefit primarily those countries developing the necessary technology which are also the largest consumers of minerals; thus many developing countries mineral exporters might be harmed by nodule exploitation.
19. Two different approaches are examined in the report for balancing the objectives of efficiency and equity: the compensatory approach, whereby the nodule industry would be allowed to operate with little or no explicit regulation, but some forms of compensation would be paid to developing countries if they experienced a loss in export revenues; and the preventive approach, which would involve some form of direct regulation of the nodule industry by an International Authority. The second approach only is discussed in detail in the report.
20. Under a general preventive approach, many specific regulatory formulae would be possible, depending on what the Authority chooses as the basis of regulation. The report considers the effects of choosing nickel as the basis for regulation. In this case, the Authority would allow new ventures to come on board and production from nodules to proceed so as to supply part or all of the increase in demand for nickel in each year. This type of scheme would recognize the complementarity between land and marine sources, since production from both sources would be growing. It would also recognize the need of the industry to remain viable, and since nickel would be one of the main generators of industry revenue, this would be assured.
21. Metal production from nodules could, for example, be geared to supplying between 50 and 100 per cent of the increase in demand for nickel, with possible additional restrictions on recovery of other component metals, such as manganese. Assuming that the demand for all these metals would be growing at their long-term rates by 1985, and the maximum production is authorized, sea-bed mining could make considerable inroads into the cobalt market, accounting for 66 per cent of world demand. The share of world demand for nickel supplied by nodules could be 28.6 per cent by 1985, under these assumptions.
22. Even taking into account a share of revenues for the International Authority, it appears that nodule mining would still show a financial return commensurate with that of other investments. On the basis of a wide range of analytical assumptions, some estimates are contained in the report. If, for example, the Authority were to take a 50 per cent share of net revenues, the medium estimate of the take from a single mining operation of 3 million tons/year would be \$96 million. This would still allow the miners a 36 per cent return on total investment after payment of the Authority's share. This is more than commensurate with the average return on investment in mining in the United States which was 10.4 per cent in 1972.
23. Whatever specific form regulation by the sea-bed Authority might take, the régime must have sufficient flexibility to adapt its mode of operation to the changing conditions of world markets and of the industry itself. Without this flexibility, the Authority would be severely hampered, and it would be extremely difficult to ensure that

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the objectives discussed under the goal of rational development would be achieved. A more practical problem will be to determine on which stage of production the take of the Authority would be based. If the value of nodules on board ship were to be used as the base, then the lion's share of the benefits from the common heritage of mankind would accrue to the producing countries. Nodules on board ship would represent only 6 to 10 per cent of the value of nodules after the processing stage. The Authority must be able to capture some of the value added by processing, since the significant spinoffs from establishing the processing plants will again go to the producing countries.

24. One possible way to tackle the objective of conservation of nodule resources would be to employ a grid system for demarcating the area of potential mining operations. Within the grid system, only selected blocks might be auctioned by the Authority to potential producers in any one year. The take of the Authority might, for example, consist of two parts: the proceeds from the auction plus a levy on net or gross revenues. The highest bidder would acquire control over the mine site for a fixed period which would be long enough to allow him to recoup his investment, after which the site would be returned, in a specified condition, to the Authority. Certain blocks would not be auctioned off immediately, but reserved for future use.

25. The range of possible policy alternatives open to the International Authority is quite wide. The regulatory options discussed in the report are by no means the only feasible alternatives. For example, it is not necessary that the Authority license commercial exploitation of nodules by private companies. Alternatively, the Authority might enter into joint ventures, or it might choose to undertake the entire operation of sea-bed mining by itself.

26. In any case, it appears that even after paying the levies of an International Authority, sea-bed mining will be a commercially profitable operation. There are concrete policy options which can balance the interests of the mineral producing and consuming nations, and some of these possible options are discussed at length in the report. It should be emphasized that the pace of change in world economic affairs - especially in regard to exchange rates, commercial policies and inflation - can significantly alter the economic picture within a few years. Any form of international regulation of sea-bed mining must be sufficiently flexible to adapt itself, its methods and objectives to the changing economic order.

III. Summary and conclusions of UNCTAD's reports

A. Summary of the statement made by Mr. G. D. Arsenis on behalf of the Secretary-General of the United Nations Conference on Trade and Development (A/CONF.62/32)

1. It is now generally agreed that greater availabilities and presumed lower costs associated with the production of minerals from the sea-bed would bring benefits to the world as a whole. How could these benefits be distributed among Member States? This is the central question.
2. The Conference would wish to take account of the following principles in answering this question:
 - (a) the sea-bed resources are the "common heritage of mankind";
 - (b) their exploitation should be "for the benefit of mankind as a whole, taking into account the special interests and needs of developing countries";
 - (c) the need for concerted international action to underpin the development of developing countries and to reduce the economic gap between developed and developing countries;
 - (d) the convergence of interests of producing and consuming countries, and consequently, of the need for a new strategy that would meet the legitimate needs of consuming countries for assured supplies and of producers for strengthened earnings and assured markets: both producers and consumers have an interest in an orderly price situation and in the rational exploitation of non-renewable resources.
3. One important result of sea-bed mineral exploitation would be that it would bring direct benefits to consumers of the minerals concerned which are, by and large, mineral using industries in developed countries.
4. The chief consequence of sea-bed production for land-based producers of the minerals concerned would be that their total earnings from the minerals would grow less rapidly than they would have done otherwise, and in some instances, they might even decline from previously realized levels. In 1980, on the level sea-bed production might reach in that year, export earnings of developing countries in that year would be about \$360 million lower than in the absence of sea-bed mining.
5. Income likely to accrue to the proposed international sea-bed authority would fall short of the potential export earnings foregone by established developing countries. The likely revenue of the authority would be insufficient to compensate those countries, nor would funds be available for the benefit of other developing countries.
6. It would appear that in the absence of special arrangements to protect the interests of developing countries, mineral production from the sea-bed while contributing to world development, may also result in a widening of the income gap between developed and developing countries.

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7. There is, therefore, an imperative need for the international community to make firm arrangements to ensure that such activity would not adversely affect the interests of developing exporting countries.
8. A compensatory approach is conceivable, but would require additional funds to meet the shortfall of the revenues of the authority in relation to the loss in export earnings of developing countries.
9. An alternative approach would consist of arrangements to ensure that output from the sea-bed will not result in prices which are not equitable and remunerative to the reasonably efficient countries which are established producers of the minerals concerned. For this purpose, strict control over production or selling prices should be exercised by the proposed international authority.
10. The establishment of a properly constituted international authority either able to undertake sea-bed mining itself or alternatively equipped with the full regulatory and taxing powers, appears to be a prerequisite to the equitable utilization of these resources.

B. Case study of copper (TD/B/484): Summary and conclusions

1. The consumption of copper has increased in the last two decades at an average annual rate of 5 per cent, and in the non-socialist world reached an annual average of 8 million metric tons in the period 1969-1971.
2. Mine production over that period totalled about 5 million tons of copper content, corresponding to a value of \$6,000 million, the difference between mine production and consumption being accounted for largely by the use of secondary copper. The share of the developing countries in that output was about 40 per cent.
3. The characteristics of the copper market, and in particular the existence of two relatively independent sub-markets, were taken into account in an econometric model which was used to simulate the behaviour of the market in the event of exploitation of the sea-bed. As in the UNCTAD secretariat's previous reports, four assumptions were made concerning the intensity of exploitation of the sea-bed. On the low assumption 14,100 tons of copper would be extracted from the sea-bed in 1980, on the medium-low assumption 42,300 tons, on the medium-high assumption 98,800 tons, and on the high assumption 141,000 tons.
4. On the assumption that in 1980, 141,000 tons of refined copper will reach world markets, the volume of copper extracted from the sea-bed would not account for more than 2 per cent of mine production, or for more than 1 per cent of consumption in the non-socialist world. According to the results of the quantitative analysis, the effect of this production might be summarized as follows, by comparison with the case of no exploitation of the sea-bed: contraction of mine production on land by 0.7 per cent, expansion of total mine production (on land and on the sea-bed) by 1.2 per cent, and expansion of consumption by 0.4 per cent in the non-socialist world. London Metal Exchange prices would drop by 2.2 per cent and United States producer prices by 1 per cent. The export earnings of the developing countries would shrink by about \$200 million, or about 3 per cent of the total.

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5. This figure may be compared with the value of the copper that would be extracted from the sea-bed on the same assumption - about \$300 million. Assuming that the profits of firms engaging in that activity is not likely to exceed half their gross receipts, it will be seen that a transfer of all or part of those profits to the developing countries would not offset the shrinkage of their potential export earnings.

C. Case study of manganese (TD/B/483): Summary and conclusions

1. This paper presents the results of an analysis of the effects of the mining of manganese nodules from the ocean floor on the land-based manganese ore industry and, in particular, on the developing country producers of such ore. These results are based on an econometric model of the manganese ore industry - summarized on page 15 - and fully described in TD/B/483/Add.1.

2. The analysis is related to a base case set of premises, which can be summarized as follows:

(a) The range of sea-bed production levels which can realistically be anticipated over the projection period (1974-80), is taken to run from a low of about 442,000 metric tons of manganese ore in 1980 to a high of about 4,420,000 metric tons of ore in the same year.

(b) Production of manganese ore from the sea-bed is assumed to be planned, broadly, on principles similar to those relating to land-based production. This will lead to a partial, though not pound-for-pound, displacement of land-source supplies by ocean-source supplies.

(c) The share of the developing countries in aggregate land-based production will remain approximately constant at its current level over the period.

(d) Real gross national product in the industrialized countries which are the principal consumers of manganese ore is assumed to grow during the projection period at recently observed rates. Further details of these assumptions and information about other assumptions made are provided in chapter II. The base case premises just summarized should be regarded as merely a reasonable reference case for study. Alternatives to certain key assumptions and the effects of these alternatives on the analytical results are considered in chapter V.

3. The principal results which flow from the base case premises and which pertain to the manganese ore industry as a whole are as follows (see chapter III for details).

4. Aggregate consumption of manganese ore in the developed market economies and in the developing countries is expected to increase at an average annual rate of about

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5.3 per cent between 1970 and 1980. 1/ This is a somewhat higher rate of increase than the average over, say, the last two decades. It reflects the anticipated relatively high rate of growth of steel production in the developing countries and an increase in the share of production by such countries in the total. Sea-bed output of manganese ore will affect the price of such ore. However, since consumption of manganese ore is very price-inelastic, consumption is unlikely to vary with sea-bed production.

5. Production of manganese ore from land sources will, of course, be affected by ocean mining operations. In the absence of sea-bed production, land-based output is anticipated to grow at an annual average rate of 4.2 per cent. Given a moderate level of sea-bed production, 2/ this rate will probably drop to about 1.5 per cent per year. In the last year of the forecast period (1980), the reduction in land volume will be from 12.6 million metric tons to 10.4 million metric tons, a reduction of about 18 per cent. 3/

6. The price of manganese ore is expected to be fairly insensitive to the level of sea-bed production. Without production from the ocean floor, price is expected to decline by about 1.1 per cent per year under the influence of continuing high production capacity, United States Government stockpile deliveries, and imports from the socialist countries. This rate of decline will accelerate to only about 1.6 per cent per annum under the assumption of a medium level of sea-bed output. The difference in prices between the two situations in 1980 is the difference between \$17.3 per metric ton and \$16.8 per metric ton. 4/ The effect of ocean mining development on the price of manganese ore is moderated by the fact that sea-bed production will to some extent supplant land-based production. Hence the effect of the former on total supplies will be mitigated.

1/ All physical quantities and values are aggregates of the developed market economies and developing countries. Published data on the manganese economies of the socialist countries were insufficient to permit representation of these countries in the econometric model on which the analysis is based. All quantities and values refer to manganese ore of metallurgical grade. Data limitations prevented inclusion of chemical-grade, battery-grade, or ferruginous manganese ore within the model. Consumption of metallurgical-grade ore, however, represents about 90 per cent of total consumption of all types of manganese ore.

2/ This is the 'medium 2' sea-bed production case shown in table 1 below.

3/ All quantities are gross weight of ore. An analysis in terms of weight of metal content would also have been of interest but was precluded by data limitations.

4/ This is a world average f.o.b. price per ton of metallurgical-grade ore, gross weight.

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7. The base set of assumptions also has implications for the export earnings of developing country producers of manganese ore. ^{5/} In the absence of an ocean mining development, the export earnings of the developing countries from the sale of manganese ore are expected to rise at an annual rate of about 3.1 per cent over the forecast period. This gain reflects the conflicting effects of an anticipated slight decline in price, offset by a moderate rise in export volume. With a medium level of sea-bed production of manganese ore, export earnings would probably decline by about 2.0 per cent per year between 1974 and 1980. These differential rates of change imply a very substantial difference in export earnings in 1980 as between the no sea-bed production case and the medium sea-bed production case, the difference between \$93.7 million in the first case and \$65.6 million in the second, a reduction of approximately 30 per cent (see chapter IV for further details).

8. As noted, the results given above rest upon a particular set of assumptions, the base set. It is of interest to determine how the figures of developing country export earnings might change in response to plausible variations in certain key assumptions. (See chapter V).

9. It could, for example, be assumed that the developing countries' share of aggregate land-based production would decline because they would feel the full effect of the displacement of land supplies of manganese ore by sea-bed production. This would be the probable result, for example, if sea-bed production were to be utilized mainly in the United States which is a distinct possibility, at least over the first few years of the forecast period. Under these circumstances, and with a medium level of sea-bed output, the export revenues of developing countries from the sale of manganese ore would decline at an annual average rate of 6.3 per cent falling to \$48.5 million by 1980. In that year, such earnings would be about 21 per cent lower than if the impact of sea-bed production had been shared equally with the developed market economies and 48 per cent lower than if there were no ocean mining.

10. Similarly, it might be assumed that the average growth rate of the industrial countries, which are at present the principal consumers of manganese ore, would be less than historically experienced. Under the influence of a temporary (two-year) reduction of growth in these countries, and given a medium level of sea-bed production, export earnings of developing countries from the sale of manganese ore would be relatively lightly affected. Under a sustained reduction of growth (one-half the recent historical rate) - once again with a medium sea-bed output - such earnings would suffer quite drastically, however, falling to \$54.2 million in 1980, a decline of 4.5 per cent per year between 1974 and 1980. In the latter year, earnings would be approximately 17 per cent less than if growth had been sustained at its historical rate. Such earnings would be 42 per cent less than if growth had been sustained and the sea-bed development had not occurred.

^{5/} Figures on another indicator of the impact on developing country producers, namely value of annual production, are given in table 7 below.

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11. All the above results obtain under an assumption of a fairly moderate scale of ocean mining operations. Under an assumption of a high - but not impossibly high - scale of operations, the effects would be even more severe.

12. The table below draws together the main analytical results relating to the effects of sea-bed production on export earnings of developing country producers of manganese ore.

Export earnings of developing countries from
manganese ore in 1980

Under the base set of assumptions		Under alternative assumptions regarding:			
		Developing countries share of land production		Reduced growth in the industrialized countries <u>a/</u>	
No sea-bed production	Moderate sea-bed production	Developed countries' production displaced	Developing countries' production displaced	Temporary reduction	Sustained reduction
(SUS million)					
93.7	65.6	86.5	48.5	62.8	54.2

a/ Taken here as the 11 major consumers of manganese ore.

13. The figures presented in the table above suggest that some sort of sea-bed regulatory régime will probably be required in order to protect the export earnings of developing country producers of manganese ore. Regulations could pertain to offering prices, production, or offers to sell the output from mining operations, or some combination of these. On the other hand, a compensatory approach to protecting the export earnings of developing countries would probably not be successful. Under any sea-bed case considered, losses in export earnings of the developing countries amount to about 50 per cent of the value of sea-bed production. Since the latter represents gross revenues, without deduction for operating costs, depreciation and amortization, and return on capital, the prospects for compensating the developing countries for loss of export earnings solely from the sale of sea-bed production of manganese ore do not appear bright. Thus, a system of regulation in which losses are prevented, rather than compensated after the fact, would seem to be indicated. Definitive statements on these matters, however, must await a joint analysis of all four principal sea-bed metals, an analysis in which interactions among the various metals and between land and ocean operations can be systematically examined.

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D. Case study of cobalt (TD/B/449/Add.1):
Summary and conclusions

1. Relative to other non-ferrous metal markets, the market for cobalt may be considerably more affected by the exploitation of mineral deposits on the ocean floor. For those sea-bed operations presently envisaged, although larger quantities of both manganese and nickel would be extracted, the amount of by-product cobalt recovered would represent a far greater proportion of current land-based production than would be the case for any other metal. It is estimated, for example, that one commercial, deep-sea mining operation could add each year around 30 per cent to current land-based cobalt production levels, while comparable proportions for manganese or nickel would be less than 5 per cent.

2. Cobalt is at present a relatively scarce, expensive metal which is nevertheless used in a wide variety of industrial products, both metallic and non-metallic. Its special properties make it particularly suited to a number of rapidly expanding, advanced-technology industries, and in these uses there are few other metals which could be substituted for it. At considerably lower prices, cobalt itself could probably be substituted for various other non-ferrous metals. In these circumstances the addition to the cobalt market of large quantities of sea-bed supplies could alter and enlarge the structure of cobalt consumption.

3. The available data relating to cobalt production, especially to production costs and pricing strategies, are insufficient to allow a quantitative assessment of production frontiers at price levels outside the range observed in the recent past. This is especially pertinent with respect to sea-bed operations and the indirect effect of lower cobalt prices on the economics of exploitation. The justification for sea-bed production depends on the recovery of other metals in addition to cobalt, particularly manganese and nickel, and the interaction effect on the various markets of sea-bed supplies of these metals has not yet been analysed. This may be particularly important in the case of the nickel-cobalt markets. Within a limited range around the current cobalt price level, however, it has been possible to undertake an econometric analysis of the cobalt market and to draw some hypothetical conclusions regarding the impact of sea-bed production.

4. According to this analysis, the impact of sea-bed production would be most evident in the drastic redistribution of production and production revenues which would result if compared with current patterns of production and trade. Gross revenues presently accruing to developing countries from cobalt production amount to approximately \$95 million annually in terms of 1970 prices. By 1980, if there were no production from the sea-bed, this latter amount is projected to increase to \$240 million, again at 1970 prices. In the event of sea-bed production, however, developing countries' revenues would be less, between \$120-\$220 million for 1980, depending on the level of sea-bed production assumed.

5. The national revenue loss to developing countries in the event of sea-bed production is thus projected - for 1980 - to be in the region of \$19 to \$120 million at 1970 prices, depending on the assumptions made. Under these same assumptions, the revenue accruing to sea-bed production in 1980 would be \$16 to \$100 million, at 1970 prices, while developing countries' revenues would remain substantially unchanged in the region of \$10 million.

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E. Exploitation of the mineral resources of the sea-bed beyond national jurisdiction: issues of international commodity policy (TD/B/449): Summary

1. In the formulation of appropriate commodity policies in relation to the exploitation of the mineral resources of the sea-bed, the international community should bear in mind the following major considerations:

(a) The potential exploitation of the mineral resources of the area of the sea-bed beyond the limits of national jurisdiction has implications of great importance for international trade and development in the minerals sector.

(b) One important result of such exploitation would be that it would bring direct benefits to the consumers of the minerals concerned who are, by and large, the mineral-using industries in developed countries.

(c) On the other hand, the chief consequence of sea-bed production for land-based producers of the minerals concerned would be that their total export earnings from those minerals would grow less rapidly than they would have done otherwise, and might even decline from previously realized levels.

(d) The impact of sea-bed production would be likely to be particularly adverse for developing producing countries, because they typically depend more heavily on the minerals concerned for their export earnings and government revenues than do developed producing countries, and for other reasons.

(e) The restrictive impact of mineral production from the sea-bed on the scope for the growth of the export earnings of the developing producing countries would be the more serious since the relatively rapid rate of growth in international trade in minerals and metals affords developing countries an opportunity of partially compensating for the stagnation of their export trade in many agricultural commodities. Curtailment of this opportunity would impair the prospects for the developing countries of achieving the targets laid down in the International Development Strategy for the Second United Nations Development Strategy for the Second United Nations Development Decade for the over-all growth of their export earnings.

(f) A compensatory approach, under which the developing producing countries affected by sea-bed production would receive compensation for the estimated adverse impact upon their export earnings, would be unworkable on account of the insufficiency of funds on the part of the sea-bed authority if these were confined to the net revenues accruing from the exploitation of the sea-bed.

(g) Therefore, firm preventive arrangements would be required in advance of the production of minerals from the sea-bed in order to ensure that such activity would not adversely affect the interests of developing producing countries. In practice, this would imply the exercise of strict controls so that the market prices of the minerals concerned are not depressed below levels declared by the international community as remunerative and equitable.

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(h) Finally, whatever organizational arrangements are made with regard to the utilization of the resources of the sea-bed - which are recognized as "the common heritage of mankind" 1/ - the international community will presumably take care that they are fully consistent with the established role of the United Nations in the formulation and implementation of appropriate international commodity policies as an integral component of an over-all strategy for development, particularly of the developing countries. 2/

F. Mineral production from the area of the sea-bed beyond national jurisdiction: issues of international commodity policy
(TD/113/Supp.4): Summary

1. The economic impact of competing production of minerals from the sea-bed, which might be expected to be adverse to varying extents for the export incomes of all established producers (in relation to the incomes which they would otherwise earn), might be particularly adverse for typical developing producing countries. This could be so for a variety of reasons:

(a) Developing producing countries typically depend more heavily on the minerals concerned (such as copper and manganese ore) for their export incomes and government revenues than do developed producing countries.

(b) The share of developing countries in world trade in certain minerals (notably manganese ore) has been declining owing to the more rapid progress made in the developed countries' production for export.

(c) The developing countries are likely to participate directly to only a small degree in the production of minerals from the sea-bed, for, because of its technically sophisticated nature and its high capital requirements, this production will no doubt be undertaken principally by interests from the affluent and technologically advanced countries.

(d) Developing countries, which are increasingly processing land minerals before export, would lose such potential export income to the extent that minerals produced from the sea-bed were processed on the mainland of the producing enterprise's "home country". Moreover, the stimulus which sea-bed production would undoubtedly impart to the existing technological trend towards the direct processing of mineral concentrates, and the avoidance of intermediate processes which are now partly carried out in developing producing countries, would aggravate the loss of potential export income on the part of developing countries.

1/ General Assembly resolution 2750 A (XXV),

2/ The International Development Strategy for the Second United Nations Development Decade makes no reference to the resources of the sea-bed presumably because, at the time it was drawn up, the potential utilization of those resources seemed remote.

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(e) The need for large-scale capital investments for the exploration and mining of sea-bed resources might adversely affect the flow of private investment into similar activities in developing countries.

(f) Because fewer alternative investment and employment opportunities exist in developing than in developed countries, particularly heavy economic and social costs will be incurred in any re-allocation of resources that may be necessitated by the competition from sea-bed production.

Some implications for policy

2. The essential problem which would arise from the production of minerals from the sea-bed would thus be the adverse impact of such production - in the absence of special arrangements - on the economic well-being of the developing producing countries concerned, and the consequential difference between the social costs and benefits of sea-bed production and its costs and benefits judged simply in terms of normal commercial criteria. The implication of this conclusion for international policy is that firm arrangements would be required in advance of the production of minerals from the sea-bed in order to ensure that such activity would not adversely affect the interests of developing producing countries or, better, would bring them, and to other developing countries, positive benefits.

3. There would appear to be two possible approaches to the problem of protecting the trade interests of the developing countries which are established exporters of the minerals in question: (a) an approach designed to obviate or minimize any potential adverse effects, and (b) an approach under which the affected countries would receive compensation for the estimated adverse impact upon their export earnings.
